1935 **MULTIPLIER PHOTOTUBES** **Zworykin, Morton & Malter (USA)**

One of the most important by-products of television research is the multiplier phototube. When electrons of one or several hundred electron volts energy impinge on a suitably prepared conducting surface, they eject 4 to 10 low-velocity electrons, multiplying the initial current by a corresponding factor of 4 to 10. Repetition of this process leads to current multiplication by an arbitrarily high factor, practically without the addition of amplification noise. If the initial current is derived from a photocathode, the tube output reflects the variation of the light incident on the photocathode with a precision which depends only on the quantum efficiency of the cathode; with proper design, the dispersion in the transit time of the electrons from the cathode to the final collector can be held to quantities of the order of 10^{-10} second.

In the earliest effective multipliers (Zworykin, Morton and Malter 1935) the electrons were guided from dynode to dynode along an approximately cycloidal path by crossed electric and magnetic fields. Purely electrostatic focusing and acceleration systems were developed subsequently by Zworykin and Rajchman and Rajchman and Synder as well as by Larson and Salinger. These may be regarded as the prototypes of present-day multiplier phototubes of RCA and DuMont. The venetian-blind design utilised in the image orthicon is also employed by EMI and RCA for multiplier phototubes. Finally, the early and very simple screen multiplier of Weiss (1936) does without focusing altogether, at the expense of materially lowered multiplication efficiency.

SOURCE: 'Beam-deflection and photo devices' by K Schlesinger and E C Ramberg *Proc. IRE* p 1001/2 (May 1962)

SEE ALSO: 'The secondary emission multiplier—a new electronic device' by V K Zworykin, G A Morton and L Malter *Proc. IRE* vol 24, p 351 (March 1936)

'The electrostatic electron multiplier' by V K Zvorykin and J A Rajchman *Proc. IRE* vol 27, p 558 (September 1939)

'Photocell multiplier tube' by C C Larson and H Salinger *Rev. Sci. Instrum.* vol 11, p 226 (July 1940)

'On secondary emission multipliers' by G Weiss *Z. Tech. Phys.* vol 17, p 623 (December 1936)